

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



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MEDICAL

Specialist's Factual Report

May 28, 2024

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A ACCIDENT

Location: Citra, Florida
Date: September 17, 2022

B MEDICAL SPECIALIST

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C DETAILS OF THE INVESTIGATION

1.0 Purpose

This investigation was performed to evaluate the pilot for potentially impairing medical conditions and substances.

2.0 Methods

The final Federal Aviation Administration (FAA) medical case review, pilot's FAA medical certification file, and the pilot's autopsy and toxicology reports were reviewed. Selected investigator reports and relevant regulation and medical literature were also reviewed.

D FACTUAL INFORMATION

1.0 FAA Medical Records

According to FAA records, the 64-year-old male pilot's last aviation medical examination was on August 25, 2022. At that time, he reported 12,100 total civilian flight hours. He was 69 inches tall and weighed 185 pounds. He reported a medical history including depression and generalized anxiety as well as high blood pressure; the aviation medical examiner (AME) noted that the high blood pressure met Conditions AMEs Can Issue (CACI) criteria. The pilot reported his medications at that time as lisinopril, a prescription medication used to treat high blood pressure, and escitalopram, a prescription medication used to treat depression. He also reported quetiapine, a prescription medication used for insomnia, mood stabilization and anxiety, and gabapentin, a prescription medication used to treat nerve pain and headaches. In February of 2022, the pilot sustained a fall and a closed head injury resulting in headaches, a neck injury, vision problems, and mood liability. At the time

of his last aviation medical examination, the pilot was still in therapy for complications from his closed head injury. The AME deferred his medical certification decision to the FAA, due to ongoing therapy and medication use of quetiapine and gabapentin.

The pilot was issued an Authorization of Special Issuance for depression and medication use originally in February 2018, with repeated renewals. The last renewal of the Authorization for Special Issuance was January 28, 2022, for major depression and anxiety treated with escitalopram. The Authorization for Special Issuance was withdrawn on June 16, 2022, for major depressive disorder with generalized anxiety treated with escitalopram with an upcoming medication change, (potential weaning of escitalopram) and recent closed head injury with residual symptoms and on-going therapy. On August 11, 2022, the pilot underwent formal neurocognitive testing. Based on the findings of the testing, the psychologist recommended the pilot for re-authorization of special issuance. On August 22, 2022 (3 days before his last aviation medical examination), the pilot had a psychiatric visit; the psychiatrist noted the pilot to be "psychiatrically stable". The psychiatrist documented in his note that the pilot was struggling with mood lability, irritability, insomnia, anxiety and feeling overwhelmed and prescribed quetiapine for sleep, mood stabilization and anxiety. At the time of the crash, FAA review of the pilot's application for medical certification was pending.¹

2.0 Autopsy

The Office of the Chief Medical Examiner (OCME) of District 5, Citrus, Hernando, Lake, Marion, and Sumter Counties, Florida, performed the pilot's autopsy. According to the pilot's autopsy report, his cause of death was multiple blunt force injuries, and his manner of death was accident. He was noted to have mild coronary artery disease with 30-40% stenosis of the distal left anterior descending coronary artery and the mid-portion of the right coronary artery as well as moderate atherosclerotic disease of the abdominal aorta. A flabby myocardium was also noted. The remainder of the autopsy examination did not identify other significant natural disease.

3.0 Toxicology

3.1 Autopsy Toxicology

At the request of the OCME, toxicology testing of postmortem chest cavity blood from the pilot was performed by NMS Labs.² Delta-9-THC was detected at 38

¹ Notably, the pilot also was not eligible to exercise sport pilot privileges without a medical certificate at the time of the crash, based on requirements of 14 Code of Federal Regulations 61.23(c)(2).

² Information about blood testing procedures, including tested-for substances, is available on the NMS Labs website at Test Code, 8051B.

ng/mL. Carboxy-delta-9 -THC was detected at more than 500 ng/mL and 11-hydroxy-THC was detected at more than 100 ng/mL. Ethanol concentration was not reported.³ No other tested-for substances were detected.

3.2 FAA Toxicology

The FAA Forensic Sciences Laboratory performed toxicological testing of postmortem specimens of the pilot.⁴ Ethanol was detected in cavity blood at 0.055 g/dL, in vitreous fluid at 0.063 g/dL, and in urine at 0.069 g/dL. Delta-9-THC was detected in cavity blood at 22.1 ng/mL and in urine at 15.8 ng/mL. Carboxy-delta-9-THC was detected in cavity blood at 87.8 ng/mL and in urine at 277 ng/mL. 11-hydroxy-THC was detected in cavity blood at 8.9 ng/mL and in urine at 739.4 ng/mL. Citalopram was detected in cavity blood at 79 ng/mL but not in urine. N-desmethycitalopram was detected in cavity blood at 51 ng/mL but not in urine. Quetiapine was detected in cavity blood at 13 ng/mL and in urine at 17 ng/mL. Norquetiapine was detected in cavity blood at 13 ng/mL and in urine at 421 ng/mL. Gabapentin was detected in cavity blood at 1835 ng/mL and in urine at 88,944 ng/mL.

3.3 Descriptions of Detected Substances

Ethanol is a type of alcohol. It is the intoxicating alcohol in beer, wine, and liquor, and, if consumed, can impair judgment, psychomotor performance, cognition, and vigilance. Effects of ethanol can significantly impair pilot performance.⁵ While the acute effects of ethanol can vary depending on an individual's frequency of use, body weight, and tolerance, in general, at blood ethanol concentrations as low as 0.02 g/dL, there is relaxation and some loss of judgment. Ethanol levels of 0.05 g/dL have been found to further degrade judgment, psychomotor functioning, and alertness. At blood ethanol concentrations above 0.1 g/dL, there is prolonged reaction time, altered perception of the environment, lack of coordination, slowed thinking, and mood and behavioral changes.⁶ FAA rules impose strict limits on flying after consuming ethanol, including prohibiting pilots from flying with a blood ethanol level of 0.04 g/dL or greater.⁷ Once ethanol is consumed, it is rapidly absorbed from

³ According to the report, ethanol concentration decreased from 0.022 g/dL to undetected over multiple analyses, possibly due to the nature of the specimen.

⁴ The FAA Forensic Sciences laboratory has the capability to test for around a thousand substances including toxins, prescription and over-the-counter medications, and illicit drugs.

⁵ Cook CCH. Alcohol and aviation. *Addiction*. 1997;92(5):539-555.

⁶ Centers for Disease Control and Prevention. Blood Alcohol Concentration (BAC). <https://www.cdc.gov/motorvehiclesafety/pdf/bac-a.pdf> February 29, 2024.

⁷ Federal Aviation Administration. Alcohol and drug use in civil aviation. Federal Register :14 Code of Federal Regulations §91.17. <https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-91/subpart-A/section->

the gastrointestinal tract and distributed into total body water. As ethanol is distributed in total body water, it uniformly distributes across tissues and into the brain.⁸ Vitreous fluid, and to a lesser extent urine, generally are better protected from microbial spread, and thus generally are less susceptible to postmortem ethanol production, than are other specimen types.^{9,10}

Delta-9-THC is the primary psychoactive chemical in marijuana and hashish, which are products derived from the cannabis plant. Delta-9-THC may be smoked or ingested recreationally by users seeking mind-altering effects. It may also be used medicinally to treat illness-associated nausea, chronic pain, and other symptoms of some chronic diseases.¹¹ Dronabinol is a prescription medication that is a pharmacologically created delta-9-THC, often used to treat involuntary weight loss secondary to chronic disease and nausea associated with chemotherapy. Dronabinol usually carries a warning that its use may impair the mental and physical abilities required for the performance of hazardous tasks such as driving a motor vehicle or operating machinery.¹² The specific psychoactive effects of delta-9-THC vary depending on the user, user history of use, dose consumed, and route of consumption. Effects of delta-9-THC consumption may impair motor coordination, decrease reaction time, impair decision making and problem solving, distort perceptions of reality, and decrease vigilance.¹³ 11-hydroxy-THC is the primary active metabolite of delta-9-THC. Carboxy-delta-9-THC is a non-psychoactive metabolite of delta-9-THC. Research shows poor and inconsistent correlation between the presence and magnitude of impairment and THC concentrations in blood in living

[91.17](#). Accessed May 18, 2024.

⁸ Jones AW. Alcohol, its absorption, distribution, metabolism, and excretion in the body and pharmacokinetic calculations. *Wiley Interdisciplinary Reviews: Forensic Science*. 2019;1(5). doi:<https://doi.org/10.1002/wfs2.1340>.

⁹ Federal Aviation Administration. Forensic Toxicology Drug Information. Ethanol. <http://jag.cami.jccbi.gov/toxicology/DrugDetail.asp?did=60>. Accessed May 18, 2024.

¹⁰ Savini F, Tartaglia A, Coccia L, et al. Ethanol Determination in Post-Mortem Samples: Correlation between Blood and Vitreous Humor Concentration. *Molecules*. 2020;25(12):2724. Published 2020 Jun 12. doi:10.3390/molecules25122724.

¹¹ Shah J, Fermo O. Review of systemic and syndromic complications of cannabis use: A review. *Medicine (Baltimore)*. 2022;101(49):e32111. doi:10.1097/MD.00000000000032111, 10.1097/MD.00000000000032111.

¹² National Institute of Health Medical Library. Marinol-dronabinol capsule. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=628f9609-6583-49be-be77-b64cfbc46fd7>. Updated May 10, 2019. Accessed May 18, 2024.

¹³ Testai FD, Gorelick PB, Aparicio HJ, et al. Use of Marijuana: Effect on Brain Health: A Scientific Statement from the American Heart Association. *Stroke*. . 2022;53(4):e176-e187. doi:10.1161/STR.0000000000000396, 10.1161/STR.0000000000000396.

persons.¹⁴ Delta-9-THC is a federally controlled substance, and the FAA considers it unsuitable for flying, regardless of state cannabis laws.^{15,16,17}

Citalopram is a prescription medication commonly used to treat major depression.¹⁸ Major depression can cause cognitive impairment, particularly of executive function. Antidepressant treatment may improve such impairment.^{19,20} In healthy individuals, studies of citalopram have not established that it causes cognitive or psychomotor impairment.^{21,22} However, citalopram sometimes carries a warning that any psychoactive drug may impair judgment, thinking, or motor skills, and that users should be cautioned about operating hazardous machinery, until they are reasonably certain that citalopram does not affect their ability to engage in such activities. A pilot on citalopram may be considered for FAA medical certification via authorization for special issuance only, due to the required detailed evaluation of the individual pilot's condition, including assessment of the pilot's cognitive function and response to medication.²³ N-desmethylocitalopram is a metabolite of citalopram.

¹⁴ Arkell TR, Spindle TR, Kevin RC, Vandrey R, McGregor IS. The failings of per se limits to detect cannabis-induced driving impairment: Results from a simulated driving study. *Traffic Injury Prevention*. 2021;22(2):102-107. doi:<https://doi.org/10.1080/15389588.2020.1851685>.

¹⁵ Federal Aviation Administration. Guide for aviation medical examiners: pharmaceuticals (therapeutic medications) do not issue - do not fly. Federal Aviation Administration website. https://www.faa.gov/ame_guide/pharm/dni_dnf. Updated June 28, 2023. Accessed May 18, 2024.

¹⁶ Federal Aviation Administration. Aeromedical factors. In: *Pilot's Handbook of Aeronautical Knowledge*. FAA-H-8083-25C. Oklahoma City: United States Department of Transportation, Federal Aviation Administration, Airman Testing Standards Branch, AFS-630; 2023. https://www.faa.gov/sites/faa.gov/files/19_phak_ch17.pdf. Accessed May 19, 2024.

¹⁷ Federal Aviation Administration. Controlled substances and CBD products. Guide for Aviation Medical Examiners. https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/media/Controlled_Substances_and_CBD_Products.pdf. Updated May 25, 2022. Accessed May 19, 2024.

¹⁸ National Institutes of Health National Library of Medicine. Celexa. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=4259d9b1-de34-43a4-85a8-41dd214e9177>. Updated October 9, 2023. Accessed May 18, 2024.

¹⁹ Snyder HR. Major depressive disorder is associated with broad impairments on neuropsychological measures of executive function: a meta-analysis and review. *Psychol Bull*. 2013;139(1):81-132. doi:10.1037/a0028727.

²⁰ Prado CE, Watt S, Crowe SF. A meta-analysis of the effects of antidepressants on cognitive functioning in depressed and non-depressed samples. *Neuropsychol Rev*. 2018 Mar;28(1):32-72. doi: 10.1007/s11065-018-9369-5.

²¹ Fairweather DB, Pozzo CD, Kerr JS, Lafferty SV, Hindmarch I. Citalopram compared to dothiepin and placebo: effects on cognitive function and psychomotor performance. *Hum Psychopharmacol*. 1997;12(2):119-126.

²² Paul MA, Gray QW, Love RJ, Lange M. SSRI effects on psychomotor performance: assessment of citalopram and escitalopram on normal subjects. *Aviat Space Environ Med*. 2007;78(7):693-697.

²³ Federal Aviation Administration. Guide for aviation medical examiners: decision considerations - aerospace medical dispositions, item 47, psychiatric conditions - use of antidepressant medications. Federal Aviation Administration website https://www.faa.gov/ame_guide/app_process/exam_tech/item47/amd/antidepressants.

Quetiapine, sometimes marketed as Seroquel, is a prescription antipsychotic medication. In the United States, quetiapine is approved by the Food and Drug Administration (FDA) as part of multi-drug treatment of major depressive disorder. It is also FDA-approved for treating schizophrenia and acute episodes of mania and depression in bipolar disorder, and as part of chronic multi-drug treatment of bipolar disorder. Quetiapine is regularly prescribed for off-label (non-FDA-approved) uses, including, in low doses, treatment of insomnia without an underlying psychiatric illness. Some other possible off-label uses include chronic single-drug treatment of bipolar disorder, as well treatment of post-traumatic stress disorder and anxiety.^{24 - 30} Quetiapine may also be misused or abused, often in combination with other recreational substances.^{34 - 33} Quetiapine commonly causes drowsiness, especially in the initial days after starting a treatment regimen; users may develop tolerance to this effect over time. Quetiapine typically carries a warning that it has the potential to impair judgment, thinking, and motor skills, and that users should be cautioned

Updated April 24, 2024. Accessed May 18, 2024.

²⁴ National Institutes of Health National Library of Medicine. Seroquel. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=0584dda8-bc3c-48fe-1a90-79608f78e8a0>. Updated January 27, 2022. Accessed April 25, 2024.

²⁵ Stovall J. Bipolar mania and hypomania in adults: choosing pharmacotherapy. In: Post TW, ed. *UpToDate*. Waltham, MA: UpToDate Inc. <https://www.uptodate.com/contents/bipolar-mania-and-hypomania-in-adults-choosing-pharmacotherapy>. Updated July 29, 2022. Accessed April 25, 2024.

²⁶ Shelton RC, Bobo WV. Bipolar major depression in adults: choosing treatment. In: Post TW, ed. *UpToDate*. Waltham, MA: UpToDate Inc. <https://www.uptodate.com/contents/bipolar-major-depression-in-adults-choosing-treatment>. Updated May 19, 2022. Accessed April 25, 2024.

²⁷ Post RM. Bipolar disorder in adults: choosing maintenance treatment. In: Post TW, ed. *UpToDate*. Waltham, MA: UpToDate Inc. <https://www.uptodate.com/contents/bipolar-disorder-in-adults-choosing-maintenance-treatment>. Updated April 19, 2023. Accessed April 25, 2024.

²⁸ Thase ME. Quetiapine monotherapy for bipolar depression. *Neuropsychiatr Dis Treat*. 2008;4(1):11-21.

²⁹ Neubauer DN. Pharmacotherapy for insomnia in adults. In: Post TW, ed. *UpToDate*. Waltham, MA: UpToDate Inc. <https://www.uptodate.com/contents/pharmacotherapy-for-insomnia-in-adults>. Updated May 24, 2023. Accessed April 25, 2024.

³⁰ Modesto-Lowe V, Harabasz AK, Walker SA. Quetiapine for primary insomnia: consider the risks. *Cleve Clin J Med*. 2021;88(5):286-294. doi:10.3949/ccjm.88a.20031.

³¹ Mattson ME, Albright VA, Yoon J, Council CL. Emergency department visits involving misuse and abuse of the antipsychotic quetiapine: results from the Drug Abuse Warning Network (DAWN). *Subst Abuse*. 2015;9:39-46. doi:10.4137/SART.S22233.

³² Kim S, Lee G, Kim E, Jung H, Chang J. Quetiapine misuse and abuse: is it an atypical paradigm of drug seeking behavior? *J Res Pharm Pract*. 2017;6(1):12-15. doi:10.4103/2279-042X.200987.

³³ Klein L, Bangh S, Cole JB. Intentional recreational abuse of quetiapine compared to other second-generation antipsychotics. *West J Emerg Med*. 2017;18(2):243-250. doi:10.5811/westjem.2016.10.32322.

about performing activities requiring mental alertness, such as operating a motor vehicle or hazardous machinery, until they are reasonably certain that the drug does not affect them adversely.²⁴ The FAA considers quetiapine to be a “Do Not Issue/Do Not Fly” medication.³⁴

Gabapentin is a medication commonly used to treat nerve pain. It may also be used to treat certain kinds of seizures. It generally carries a warning that use may cause somnolence, dizziness, and general central nervous system depression. Precautions are advised for driving a vehicle or operating heavy machinery until the user can assess the impact of dosing on alertness and motor activities.³⁵ Gabapentin is most commonly prescribed for off-label uses such as insomnia, anxiety, depression, migraine, analgesia related to neuropathic pain, postoperative pain, and fibromyalgia.³⁶ According to the FAA medical case review, regular use of gabapentin is unacceptable for FAA medical certification.

E SUMMARY OF MEDICAL FACTS

According to Federal Aviation Administration (FAA) records, the 64-year-old male pilot’s last aviation medical examination was on August 25, 2022. At that time, he reported a medical history including depression and generalized anxiety as well as high blood pressure. He reported using the medications quetiapine, lisinopril, escitalopram, and gabapentin. In February of 2022, the pilot sustained a fall and a mild closed head injury resulting in headaches, neck pain, vision problems, and mood lability. At the time of his last aviation medical examination, the pilot was still in therapy for complications from his closed head injury. The aviation medical examiner (AME) deferred his medical certification decision to the FAA, due to ongoing therapy and medication use of quetiapine and gabapentin. Prior to his last aviation medical examination, the pilot underwent formal neurocognitive testing. Based on the results, the psychologist recommended re-authorization of special issuance. In addition, the pilot had a psychiatric visit; the psychiatrist noted the pilot to be psychiatrically stable. At the time of the crash, FAA review of the pilot’s application for medical certification was pending.

³⁴ Federal Aviation Administration, Guide for Aviation Medical Examiners. Pharmaceuticals. Do Not Issue- Do Not Fly. https://www.faa.gov/ame_guide/media/DNI_DNF_tables.pdf. Updated June 28, 2023. Accessed May 19, 2024.

³⁵ National Institutes of Health National Library of Medicine. Neurontin-gabapentin capsule. DailyMed. <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=ee9ad9ed-6d9f-4ee1-9d7f-cfad438df388> . Updated July 12, 2022. Accessed April 24, 2024.

³⁶ Bierly JJ, Chan-Hosokawa A. Gabapentin in drugged driving investigations. *J Forensic Sci.* 2024; 69: 986-92. <https://doi.org/10.1111/1556-4029.15500>.

According to the pilot's autopsy report, his cause of death was multiple blunt force injuries, and his manner of death was accident. He was noted to have mild coronary artery disease with 30-40% stenosis of the distal left anterior descending coronary artery and the mid-portion of the right coronary artery as well as moderate atherosclerotic disease of the abdominal aorta. A flabby myocardium was also noted. The remainder of the autopsy examination did not identify other significant natural disease.

Postmortem toxicological testing of one cavity blood specimen detected delta-9-THC at 38 ng/mL, carboxy-delta-9-THC at more than 500 ng/mL, and 11-hydroxy-THC at more than 100 ng/mL. In additional specimens, delta-9-THC was detected in cavity blood at 22.1 ng/mL and in urine at 15.8 ng/mL. Carboxy-delta-9-THC was detected in cavity blood at 87.8 ng/mL and in urine at 277 ng/mL. 11-hydroxy-THC was detected in cavity blood at 8.9 ng/mL and in urine at 739.4 ng/mL. Ethanol was detected in a cavity blood specimen at 0.055 g/dL, in vitreous fluid at 0.063 g/dL, and in urine at 0.069 g/dL. Citalopram was detected in cavity blood at 79 ng/mL and was not detected in urine. N-desmethylocitalopram was detected in cavity blood at 51 ng/mL and was not detected in urine. Quetiapine was detected in cavity blood at 13 ng/mL and urine at 17 ng/mL. Norquetiapine was detected in cavity blood at 13 ng/mL and urine at 421 ng/mL. Gabapentin was detected in cavity blood at 1835 ng/mL and urine at 88,944 ng/mL.

Submitted by:

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